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Systematic Position of *Clemmys strandi* (SZALAI, 1934) *(Testudines, Emydidae)*, from the Upper Oligocene of Cluj (Rumania)

[Pls. XIII—XIV and 2 text-figures]

Stanowisko systematyczne *Clemmys strandi* (SZALAI, 1934) *(Testudines, Emydidae)* z górnego oligocenu Cluj (Rumunia)

Систематическое положение ***Clemmys strandi*** (SZALAI, 1934) ***(Testudines, Emydidae)*** из верхнего олигоцена Клуж (Cluj, Румыния).

INTRODUCTION

The fossil remains of turtles described in this paper were found in the upper layers of Ticu, directly under a Cyrena bed of the Cetate horizon on the southern slope of the Cetățuia Mts. in Cluj (Kolozsvár). It has been established that these layers dated from the Upper Oligocene (A. KOCH, 1894; G. RĂILEANU and E. SAULEA, 1956; N. MÉSZÁROS, 1959; J. IMREH and N. MÉSZÁROS, 1960). The Ticu layers are of terrestrial and fresh-water origin and consist of sandy clays, banded red clays, sands, and sandstones, their total thickness being up to 100 m. In these formations, known to geologists and palaeontologists for about a hundred years, the following layers may be distinguished:

a. Sandy clay of varying thickness.

b. Compact, hard, light grey, slightly bituminized, fresh-water limestones, about 20 cm thick and bearing fairly numerous fossils of molluscs (*Planorbis* cf. *cornu* BRONGNIART, *P. discus* EDWARDS, and *Melania escheri* MÉRIAN) and turtles.

c. Grey marly clays with a thickness of about 10 cm containing a very rich molluscan fauna (*Planorbis discus* EDWARDS, *P. cornu* BRONGNIART, *P. depressus* NYST, *Congaria unguiculus* SANDBERGER and five other species of this genus described by A. VERESS, *Hydrobia obtusa* SANDBERGER, *H. melliferens*

SANDBERGER, *Bythinia pupa* NYST, *Melania escheri* MÉRIAN, *Lymnaea socialis* SCHUBEL, *Archaeozonites subverticilis* SANDBERGER).

d. Thin layer of lignites and soft marls with remains of turtles and tapirs.

These strata are superimposed by another layer, about 35 cm thick, with shells of the members of the genus *Cyrena* (*Cyrena convexa convexa* BROGNIART and its variations, *Corbula henkelusiana* NYST, and others). In this layer there are also bones of turtles, which are here allochtonic, redeposited.

The occurrence of turtles in the above-mentioned layers of Cluj was recorded by several authors. According to A. KUBACSKA (1928) and T. SZALAI (1934) the first record of the reptiles in question found at this locality was published by J. E. FICHTEL in 1847. A long time later, L. LORENTHEY (1903) described two new species of the group *Trionychoidea* from Cluj, *Trionyx clavatomarginatus* LORENTHEY and „*Euclastes*" *kochi* LORENTHEY. In the opinion of A. KOCH (1889/1890; cited after T. SZALAI, 1934) the latter species should be included in the genus *Trachyaspis* H. v MEYER *(Anosteiridae)*, but the systematic position of this interesting turtle still does not seem quite well founded. It is our intention to describe the fossil remains of these turtles, stored up in the collections of the University Museum in Cluj and the Institute of Geology in Budapest, in our next publication. In the present paper we shall deal with the remains of turtles of the family *Emydidae* worked out by T. SZALAI (1932, 1934) and some new remains of these animals from the same locality.

DESCRIPTION

Order *Testudines*

Suborder *Cryptodira*

Section *Testudinoidea*

Family *Emydidae*

We managed to ascertain the presence of only one species of the family Emydidae in the material so far collected at our locality.

Genus *Clemmys* RITGEN, 1828

Clemmys strandi (SZALAI, 1934)

Syn.: *Emys strandi* T. SZALAI, Folia zool. hydrobiol., 1934, pp. 108—111, Pl. 1/2, figs. 1—6.

Material. — 1. Large fragment of the anterior lobe of plastron with the hyoplastral part of the bridge and the cast, on which the suture lines of the missing parts are visible. 2. Fragment of the left hypoplastron with part of the bridge broken belonging to the same individual. 3. Marginal plates m-9, 10, and 8 (or 7) of the same individual or a specimen similar in size. 4. Marginal plate m-6 (or 7) with the prints of furrows of the inguinal shield of a smaller specimen. 5. Frag-

ment of neural plate n-1 of a big specimen. 6. Fragment of the nuchal plate of the same specimen. 7. Articular part of the coracoideum. 8. Head of the femur partly exposed from the argillaceous rock. 9. Articular part of the scapula. 10. Phalanges, carpal bones, and small unidentified fragments of skeleton, all of the same fairly large specimen.

The remains specified above probably represent only two individuals varying in size. Owing to this fact it was possible to fit and stick a number of fragments of the anterior plastral lobe together. All the bony fragments are completely fossilized and dark brown, almost black, in colour. It was difficult to remove them from the hard calcareous clay.

The well-preserved fragment of the anterior plastral lobe and the prints of sutures of the missing parts on the interior mould made the reconstruction of the whole anterior part of the plastron possible (fig. 2). It is characterized by the following details of the structure:

The epiplastral plates are broad, flat, and thinner at the edges touching each other. The general appearance of these plates is the same as in the specimen used by T. Szalai (1934, Pl. 1, figs. 1—2) for description. The entoplastron is broad, obviously broader than long, traversed by two branches of the „pathologically" splitting humeropectoral furrow. The width, the pentagonal shape of this plate, and the manner in which its surface is traversed by the humeropectoral furrow resemble the corresponding details in the modern members of the Asiatic genera *Geoemyda* Gray and *Chinemys* M. A. Smith. The hyoplastron has a very well developed bridge portion. The width, general appearance, and massiveness of this portion suggest a strong bony connexion of the plastron with the carapace (Pl. XIII, phots. 1—2). The bridge portion of the plastron is of decisive importance at the determination of the generic position of these turtle remains. The furrows, well visible on the external surface of the plastron, allow the reconstruction of the shape of all the dermal shields. Thus, the gular shields are fairly broad, separated by the medial furrow. The humeropectoral furrow joins the furrows of the large triangular axillary shields and ascends mildly towards the midline. The shape of the shields of the anterior lobe is

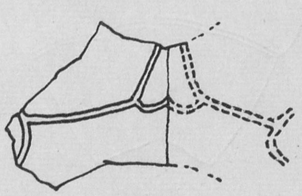


Fig. 1

similar to that in the specimens of Szalai (op. cit.). After the reconstruction of the lost fragments the length of the anterior lobe amounts to 83 mm, the width measured along the humeropectoral furrow is 82 mm, the width of the hypoplastral part of the bridge 44 mm, the length of the entoplastron 17 mm, and the width of the entoplastron 26 mm. The fragments of the carapace are

few and small. They are stout and their external surfaces are smooth. The marginal plates are thick, crossed by the costomarginal furrow, which runs close to their inner margins (Pl. XIV, phots. 3). The fragments of the nuchal plate preserved allow its partial reconstruction (fig. 1). The shape of the nuchal shield is hardly seen in the photograph presented by SZALAI in his work (op. cit.).

As for the bones of limbs, special attention should be given to the fragment of femur with a well-developed head. Its general appearance, the shape of processes, and the flexure are different from the corresponding characters in the modern members of the species *Emys orbicularis* (LINNAEUS) and *Clemmys caspica* (GMELIN). The well-developed articulating portion of the femur indicates the great mobility of the hind-limbs. The appearance of the carpal bones and phalanges (Pl. XIV, figs. 5) also suggests a remarkable development of the limbs and their good adaptation for swimming.

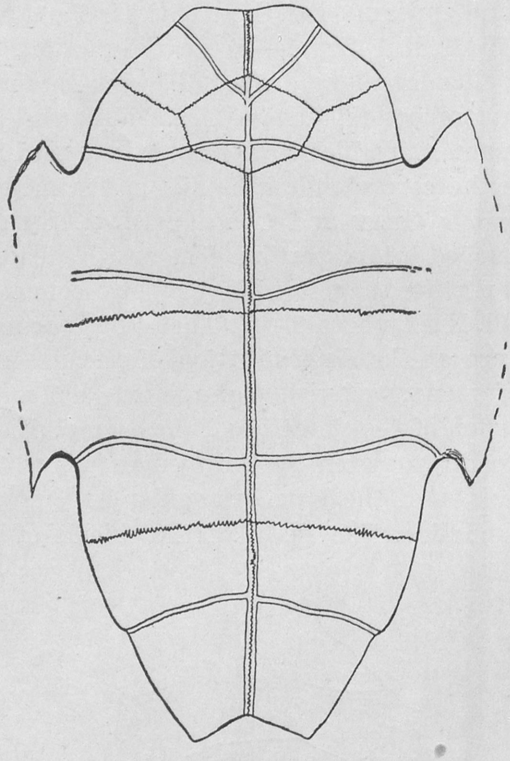


Fig. 2

DISCUSSION

The species *Clemmys strandi* (SZALAI) was described by T. SZALAI (1934) on the basis of fairly rich materials consisting of a well-preserved anterior lobe of plastron, single xiphiplastral plate of the same individual, nearly whole

carapace, and several isolated marginal plastes. Unluckily, the author did not say exactly which of these fossils was to be regarded as the holotype. The fragments of the plastron seem to be the most important and characteristic, and it is these remains that show the same structure as the remains described above (naturally, allowing for individual variations and „pathologic“ features of our specimens). Since they all come from the same locality, it may be taken that they belonged to the members representing the same species.

After a rather long argumentation T. Szalai (op. cit.) included the species described by him in the genus *Emys* A. Duméril. He grounded his view first of all on the width of the bridge in relation to the length of the plastron and on the structure of the costal plates. In the light of the remains described in the present paper and his own material, Szalai's opinions need revision. As far as the plastron is concerned, Szalai had at his disposal an anterior lobe with the hyoplastral portions broken off and lost (see Szalai, 1934, Pl. 1, figs. 1—2 (plastron)). Owing to this fact the determination of the so-called bridge index seems to be too hazardous. Although the bridge index is a very important taxonomic factor, the morphology of the bridge and particularly that of its margins connecting the plastron with the carapace is an equally important and probably decisive characteristic. The costal plates mentioned by Szalai are characteristic of *Emys orbicularis* (Linnaeus), but similar ones may be found in a number of other, not mentioned by this author, emydids.

A fairly distinct resemblance of *Cl. strandi* (Szalai) to the Recent European Pond Tortoise in the structure of the carapace (smooth surface of plates, broad costals, lack of any margins) should be assumed to be a generic character of this turtle. The general appearance and morphology of such parts of the plastron as bridge, epiplastral plates, and dermal shields also suggest that it is a distinct form different from all other Tertiary European emydids. Summing up this discussion, we can support the change of the genus of the species under study as follows: 1. The morphology of the bridge-margins and the width of the bridge indicate a firm connexion between the plastron and the carapace. 2. The xiphiplastral plates have a typical appearance resembling that of the corresponding plates in the members of the *Clemmys* Ritgen. 3. The nuchal shields are broader than those of the members of the genus *Emys* A. Duméril standing close to the Recent European Pond Tortoises. The characters of the genus *Clemmys* are particularly well visible in the reconstruction made on the basis of the specimens of Szalai (op. cit.) and those described in this paper (fig. 2).

The genus *Clemmys* Ritgen is represented by relatively numerous species in Asia, Europe, and North America, where they have occurred since the late Tertiary up to now. It is a well-known fact that many fossil emydids with a firm bony connexion of the armour have been reckoned in this genus, because they could not be exactly indentified generically owing to the lack of other distinctive characters. The belonging of our species to this genus may be recognized for well founded, on the basis of such materials. *Cl. strandi* (Szalai) shows some similarity to the members of the genus *Chinemys* M. A. Smith (formerly *Geo-*

clemys GRAY part.). the occurrence of which in the Tertiary was ascertained by M. F. GLAESSNER (1933, pp. 353—355). Unfortunately, the differences in the morphology of the armour of these turtles are so slight that much richer and complete comparative materials would be needed to prove their occurrence. The lack of studies on the taxonomic characters of the armours of the recent turtles also makes this task impossible.

GENERAL REMARKS

The presence of turtles of the genus *Clemmys* and, still more so, the presence of soft-shelled turtles *(Trionyx, Trachyaspis)* are very characteristic of large, fairly deep, freshwater reservoirs. In our case this inference coincides with the results of the analysis of the molluscan fauna (see Introduction). Light grey clays and the occurrence of such mud-inhabiting genera of snails as *Planorbis* or *Lymnaea* indicate that large areas of the reservoir bottom were very muddy. The relief of the region and its geological structure suggest that the lake was large and on the north it may have had a connexion with a sea bay of brackish water. The presence of turtles resembling the modern species of south-east Asia corroborates the presumtion that the climate was hot, probably sub-tropical.

The members of the genus *Clemmys* are remarkably more associated with water environment than the members of the genus *Emys*, but, like most emydids, they live close to the shore. The occurrence of fairly numerous remains of *Cl. strandi* (SZALAI) together with the remains of tapirs is here connected with the littoral zone. The good adaptation of this species for swimming is indicated by the structure of its armour and limbs (width and size of apertures between plastron and carapace, structure of femur, length of phalanges).

The generic revision of *Cl. strandi* (SZALAI) is not indifferent to the knowledge of the phylogenesis of the Recent European Pond Turtle. The former has hitherto been regarded as a very close and even ancestral form to *Emys orbicularis* (LINNAEUS) (T. SZALAI, 1934; M. MŁYNARSKI, 1953), because the other Oligocene member of this genus, *Emys grepiacensis* BERGOUNIOUX, shows a different type of structure (F. M. BERGOUNIOUX, 1935). The Miocene species, *Emys aquitanensis* BERGOUNIOUX from Sansan belong to a quite different, still more terrestrial, group of genera. Thus, at the present stage of chelonological studies we do not know the ancestors of the European Pond Tortoise yet. The oldest fossil remains of this modern species are known only from the Pliocene and early Pleistocene (Koněprusy, Hajnáčka in Czechoslovakia, Rębielice Królewskie in Poland). The remains of the specimens from these localities do not quite differ from the corresponding fragments of modern specimens.

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STRESZCZENIE

Praca niniejsza zawiera rewizję rodzajową kopalnego żółwia z rodziny *Emydidae* opisanego przez T. SZALAIA (1934, str. 108—111) pod nazwą *Emys strandi* SZALAI, pochodzącego z górnego oligocenu Cluj (Kolozsvár) w Rumunii. W części wstępnej podano charakterystykę geologiczną miejsca znalezienia szczątków żółwi oraz dokonano przeglądu dotychczasowych prac poświęconych kopalnym żółwiom Siedmiogrodu. W części opisowej omówiono dokładnie nowe szczątki przedstawiciela omawianego gatunku oraz uzasadniono celowość zmiany jego przynależności rodzajowej i zaliczenia go do rodzaju *Clemmys* RITGEN. W części ogólnej omówiono krótko środowisko ekologiczne, w jakim prawdopodobnie żyli przedstawiciele omawianego gatunku. Zwrócono również uwagę na znaczenie powyższej rewizji dla poznania filogenezy współczesnego żółwia błotnego (*Emys orbicularis* (LINNAEUS)), za którego przodka uważano dotychczas omawiany gatunek.

РЕЗЮМЕ

В настоящей работе приводится ревизия ископаемого рода черепах из семейства *Emydidae*, описанного Т. Шалаем (T. SZALAI 1934, стр. 108—111) под названием *Emys strandi* SZALAI относящегося к отложениям верхнего олигоцене Клуж

(Cluj, Kolozsvár) Румынии. Во вступительной части приводится геологическая характеристика места находки остатков черепах, а также просморт появившихся до сих пор работ, посвященных ископаемым черепахам Семиграда. В описательной части работы, подробно рассмотрены новые остатки представителя описываемого вида, обоснована целесообразность изменения его родовой принадлежности и причисления его к роду *Clemmys* Ritgen. В общей части работы рассмотрена предполагаемая экологическая среда, в которой жили представители рассматриваемого вида. Подчеркивается также значение приведенной ревизии для изучения филогенеза современной болотной черепахи. (*Emys orbicularis* (Linnaeus)), предком которой до сих пор считался рассматриваемый вид.

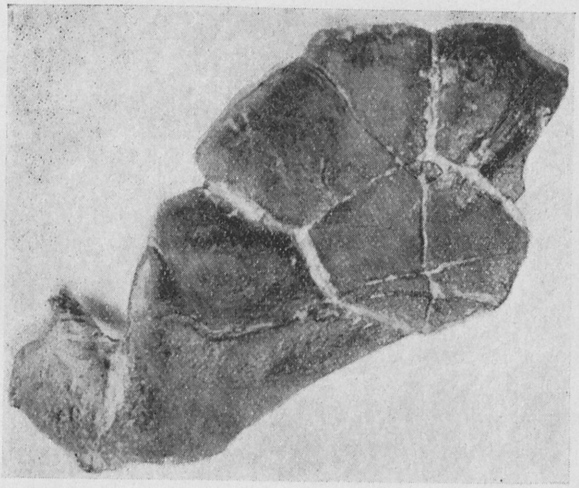
PLATES

Plate XIII

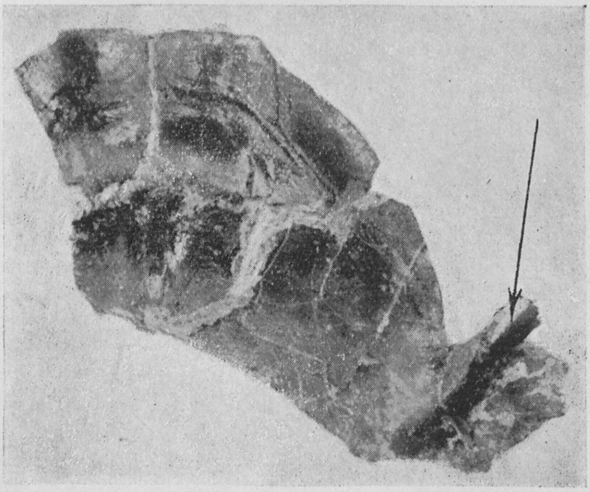
New fossil remains of *Clemmys strandi* (SZALAI)

Fig. 1. Outer aspect of the anterior lobe of the plastron.

Fig. 2. Inner aspect of the same fregment. The arrow points to the hyoplastral portion of the bridge.



1



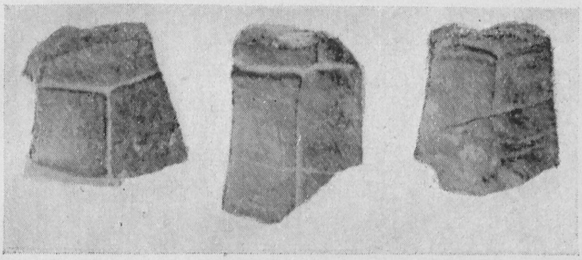
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Phot. L. Sych
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Plate XIV

New fossil remains of *Clemmys strandi* (Szalai)

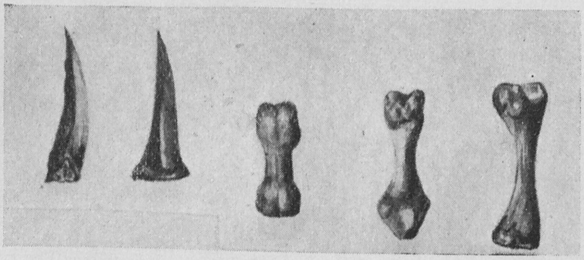
Fig. 3. Marginal plates
Fig. 4. Fragment of the nuchal plate
Fig. 5. Phalanges
Fig. 6. Haed of the femur



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4



5



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Figs 3—4 phot. L. Sych
Figs 5—6 del. M. Mészáros
M. Młynarski & M. Mészáros

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